

PATHWAYS

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PAINTING CAN BE FUN

Art and craft classes occupy an important position in the pre-primary and primary classes. Yet how often do "drawing classes" give children an opportunity to develop their own creative talents? Frequently our young learners do little more than copy a "picture" which the teacher has drawn on the blackboard. Using brushes and paint (rather than tiny crayons which are difficult for small fingers to hold) helps develop muscular control. Here are some tips for the teacher who is bold enough to experiment with her class.

Aim for a good working atmosphere where children can enjoy painting and continue to learn. Know what to suggest (techniques) and when not to interfere (choice of colours, subject matter). Don't ask a young child what he/she has painted. Encourage the student instead, with, "That looks interesting. Tell me about it".

Crowded classrooms and tables usually mean small sizes of paper and shorter periods of concentration. The quality of a child's work is often directly related to the amount of space

available. Easels are useful to display finished work but are not easy to work on. If table space is limited, spread newspapers on the floor and make sure there that there is adequate elbow room between the students.

Provide paper as large as possible - the reverse of old charts, newsprint or newspaper are some possibilities. These need not always be oblong in shape. Selecting a suitable paper from a variety of shapes, colours and textures adds interest to the exercise. Sometimes, especially for painting patterns, it is stimulating to restrict the choice of colours.

Young children do not need a wide range of colours. Red, clear yellow, blue, black and white are adequate. They can easily be mixed to obtain other shades like orange, green, brown and grey. Powder colours, ready-mixed, may be kept in wide-mouthed jars or bottles in a tray (which takes care of all spills). This material may perhaps be shared by two students.

Teach children simple but important rules like always returning a brush to its own colour,

wiping off excess paint on the rim of a pot of paint, rinsing brushes and squeezing out the water before re-use, avoiding dilution of a prepared paint and washing and storing of brushes upside down when work is complete.

Provide as good a selection of brushes as possible. At least three sizes - a fat bristle, a thin bristle and one fine brush (for detail) - may be put into each pot of paint. Some long handled brushes must be available to help young children acquire confidence in painting large areas with a sweeping, firm hand.

Show children how to paint by practising brush strokes. A short spell of this before they

work on individual paintings is usually enjoyable. This practice could use up small papers of varying sizes and shapes, and often stimulates children to do larger works.

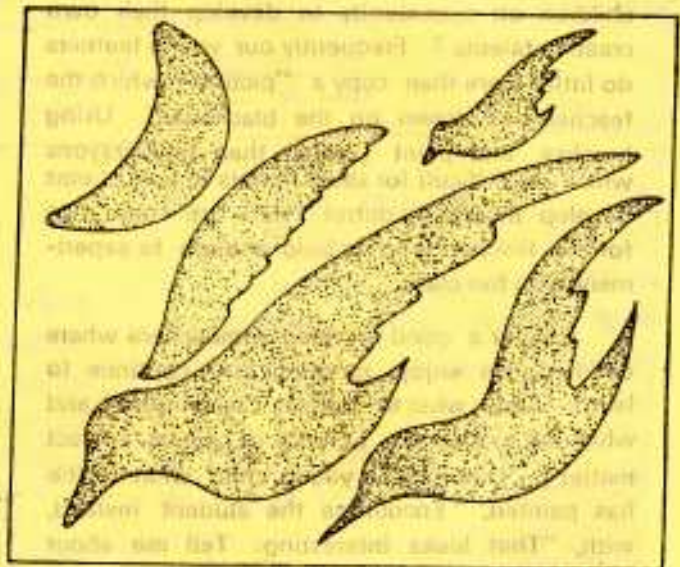
Encourage long, continuous, sweeping lines—both straight and wavy ones. Practise a wide variety of line and shape to develop a smooth, free movement of the arm. A long strip of paper is a good idea for a fence pattern. Practise circles and blobs, fish and balloon patterns. The wrist should curve the brush gently while holding in upright.

Have fun!

PAINTING CAN BE FUN STAINED GLASS WINDOWS

Materials

- A sheet of black chart paper
 - Scissors, pencil, glue
 - Coloured tissue paper or cellophane paper
1. Draw some simple shapes or a picture on to the black paper. Try not to get too close to the edge of the paper and don't draw the shapes too close together. Cut the shapes out. This will leave lots of holes.
 2. Alternatively make holes by tearing a few pieces out of the centre of the paper. You could try to make a symmetrical pattern.
 3. Lay the black paper on to a covered table top and stick the coloured paper over the holes.
 4. When it is dry you can hang the picture on a window where the light will shine through the coloured paper.



MATHS CLUB IDEAS

The apparently abstract idea of a sum to an infinite number of terms in a geometric series is brought out here.

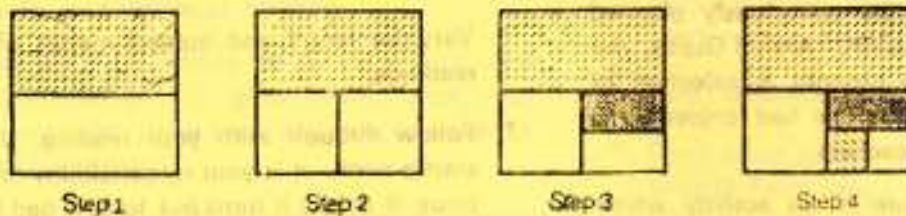


Fig 1

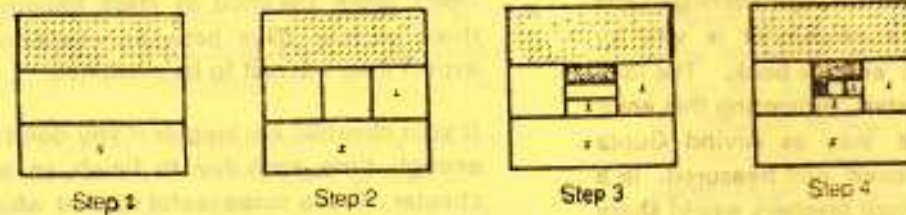


Fig 2

In the series

$$1 + r + r^2 + \dots + r^{n-1} = \frac{r^n - 1}{r - 1}$$

Put $a = 1$. Let $r < 1$.

Subtracting 1 from both sides and summing up to infinite terms, we get

$$r + r^2 + r^3 + \dots = \frac{-1}{r-1} - 1 = \frac{-1-r+1}{r-1} = \frac{-r}{r-1} = \frac{r}{1-r}$$

(r^n is infinitely small and is therefore discarded)

In figure 1, when $r = 1/2$, we have

$$\frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \dots = \frac{1/2}{1-1/2} = \frac{2/2}{2-1} = 1$$

In Figure 2, when $r = 1/3$, we have

$$\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} + \dots = \frac{1/3}{1-1/3} = \frac{1}{3-1} = \frac{1}{2}$$

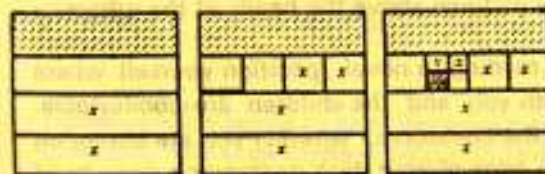


Fig 3

In Figure 3, when $r = 1/4$, we have

$$\frac{1}{4} + \frac{1}{4^2} + \frac{1}{4^3} + \dots = \frac{1/4}{1-1/4} = \frac{1}{4-1} = \frac{1}{3}$$

Saroja Sundararajan
Madras

THE JOYS OF READING

Books are objects to be enjoyed, they bring pleasure.

This session was very consciously planned as purely a sharing session. Arvind Gupta, the Resource Person, had brought a selection of children's literature which he had enjoyed and shared these with the teachers.

Reading for pleasure is an activity which grows and is encouraged through *sharing*. The creation of a *reading environment* is vital for children to pick up and enjoy a book. The idea of this session was to start promoting this environment. In the same way as Arvind Gupta shared books he had loved and treasured, in a follow-up session in April teachers would share with each other books they had enjoyed. We found this greatly generated an interest and excitement in books. It is hoped that this same sharing would then percolate into classrooms, where teachers can take books into classrooms and talk about them and share them. They could then ask children to bring in books they had liked and slowly create a climate for reading. One extremely important point to remember is that *interest in reading has to be very carefully nurtured. It is killed forever if a child is forced to read. It is a habit which will develop and grow if the environment is conducive.*

The Do's and Don'ts of Read Aloud :

DO'S :

- * Begin reading to children as soon as possible. The younger you start them, the better.
- * Use Mother Goose rhymes and songs to stimulate the infant's language. Simple but boldly drawn picture books will help arouse the child's senses of sight and curiosity.
- * Read as often as you and the child (or class) have time for.
- * Remember that the art of listening is an acquired one. It must be taught and cultivated gradually - it doesn't happen overnight.
- * Start with picture books and build to story-books and novels.
- * Vary the length and subject matter of your readings.
- * Follow through with your reading. If you start a book, it is your responsibility to continue it-unless it turns out to be a bad book. Don't leave the child or class hanging for three or four days between chapters and expect their interest to be sustained.
- * If your chapters are long or if you don't have enough time each day to finish an entire chapter, find a suspenseful spot at which to stop. Leave the audience hanging, they'll be counting the minutes until the next reading.
- * Allow your listeners a few minutes to settle down and adjust their feet and minds to the story. If it's a novel, you might begin by asking if anyone remembers what happened when you left off yesterday. Mood is an important factor in listening. An authoritarian "Now stop that and settle down! Sit up straight. Pay attention!" is not conducive to a receptive audience.
- * If you are reading a picture book, make sure the children can see the pictures easily. In class, with the children in a semicircle around you, seat yourself just slightly above them so that the children in the back row can see the pictures above the heads of the others.
- * In reading a novel, position yourself where both you and the children are comfortable. In the classroom, whether you are sitting on the edge of your desk or standing, your head should be above the heads of your listeners for your voice to carry to the far side of the room. Do not sit at your desk and read or stand in front of brightly lit windows, which strain the eye of your audience.

- * Remember that even sixth class-students love a good picture book now and then.
- * Remember that reading aloud comes naturally to very few people. To do it successfully and with ease you must practice.
- * Adjust your pace to fit the story. During a suspenseful part, slow down, draw your words out, bring your listeners to the edge of their chairs.
- * Bring a book with you whenever you travel with a child. That traffic jam on the way to the beach or the long wait at the dentist's office is a perfect time for a chapter or two.
- * Arrange for time each day - in the classroom or in the home-for the child to read by himself (even if "read" only means turning pages and looking at the pictures). All your read-aloud motivation goes for naught if the time is not available to put it into practice.
- * Lead by example. Make sure your children see you reading for pleasure other than at read-along time. Share with them your enthusiasm for whatever you are reading.

DON'TS :

- * Don't read stories that you don't enjoy yourself. Your dislike will show in the reading, and that defeats your purpose.
- * Don't continue reading a book once it is obvious that it was a poor choice. Admit the mistake and choose another (you can avoid this by pre-reading the book yourself).
- * If you are a teacher, don't feel you have to tie every book to classwork. Don't confine

the broad spectrum of literature to the narrow limits of the curriculum.

- * Consider the intellectual, social, and emotional level of your audience in making a read-aloud selection. Challenge them, but don't overwhelm them.
- * Don't read above a child's emotional level.
- * Don't select a book that many of the children already have heard or seen on television. Once a novel's plot is known, much of their interest is lost. You can, however, read a book ahead of its appearance on television or at the movies. Afterwards, encourage the children to see the movie. It's a good way for them to see how much more can be portrayed in print than on the screen.
- * Don't be fooled by awards. Just because a book won an award doesn't guarantee that it will make a good read-aloud. In most cases, a book award is given for the quality of writing, not for its read-aloud qualities.
- * Don't be unnerved by questions during the reading, particularly from very young children. Answer their questions patiently. Don't put them off. Don't rush your answers. There is no time limit for reading a book but there is a time limit on a child's inquisitiveness. Foster that curiosity with patient answers - then resume your reading.
- * Don't use the book as a threat - "If you don't pick up your room, no story tonight"! As soon as the child or class sees that you've turned the book into a weapon, they'll change their attitude about books from positive to negative.

— Source : The Read Aloud Handbook
by Jim Trelease

[The above report, written by Keerti Jayram of the Ramjas School Teachers' Centre, is based on a Workshop : The Joys of Reading, held at the Centre on March 10, 1991.]

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School children learn many things which are no doubt useful, but they gradually forget that the essential thing is to be human and kind and playful, and to make life richer for ourselves and others.

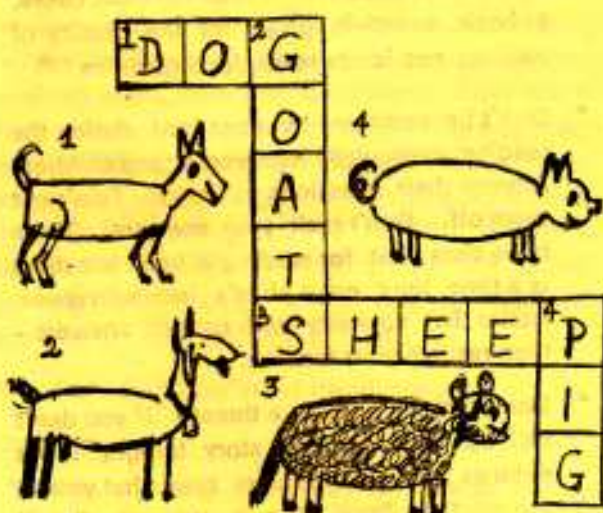
—Jawaharlal Nehru

Crosswords as a Teaching Aid

Anisha Gadekar

Few academic exercises for school children combine learning with fun as well as crossword puzzles. The completion of a crossword, irrespective of its level of complexity, provides a great sense of satisfaction. It is a challenge met and answered. It is a vindication of one's knowledge.

For very young children, just beginning to spell one or two syllable words, crosswords are best used with visual clues (instead of words) like pictures of animals, as in this puzzle.



Of course, children will initially need the help of the teacher, to learn to write words "across" and "down".

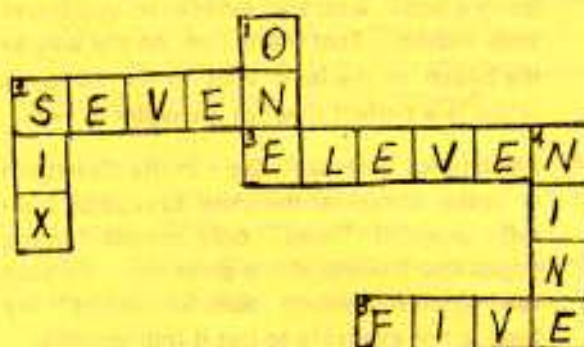
In the same way, students can practise the spellings of numbers learnt by using crosswords. The clues may be the numbers themselves as here.

Across

2. 7
3. 11
5. 5

Down

1. 1
2. 6
4. 9



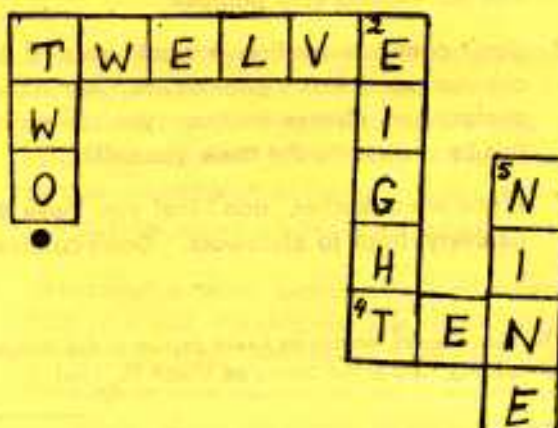
This can be further followed up with crosswords that test both arithmetic as well as spellings. In the sample puzzle given the clues are really sums.

Across

1. $6 \times 2 =$
4. $5 + 5 =$

Down

1. $4 \div 2 =$
2. $6 + 3 =$
3. $3 \times 3 =$



It goes without saying, that teachers will prefer to use separate crosswords for addition, subtraction, multiplication and division, rather than a composite one like the one above. This

crossword is merely to show that sums of all four sorts can be worked out and the correct solutions will interlock to solve the crossword successfully.

The child's performance in solving the puzzle can be excellent feedback for the teacher. Other topics for spellings practice with pictures as clues, can be the names of colours, fruits, vegetables and so on. For older children, picture and number clues can be replaced by verbal clues.

Crosswords are also a good aid for expanding children's vocabulary. For example, a picnic or a visit to a zoo or post office or park, may be followed up with a crossword puzzle of this sort. The context here is a circus. Use picture or word clues.



For older children, the process of teaching all school subjects—language, science social studies—can be livened up with the use of this versatile puzzle. They can find synonyms for given words. You can teach similes or test what the class knows about agriculture in the Punjab or about different sources of energy by quizzing the children through puzzles.

One of the best uses of the crossword is as an aid for teaching foreign languages. Many schools today offer a choice of European languages, particularly French and German, to middle school students. Crosswords can help to test and increase their vocabulary. They also make the student reach out for the dictionary in search of the right word. And this is a habit all teachers would like to foster in their students. Readers of PATHWAYS have already seen many examples of crosswords in Hindi,

Much however, depends on the resourcefulness of the teacher and the time he or she is prepared to invest in making good clues. It is of the essence, that these are clear and well defined, so that there can be no second word that fills the blank accurately.

Some teachers have successfully asked students to make up their own crosswords and use them to test each other. This involves the children in locating new words, using a dictionary and thinking up good clues.

For the perfectionist teacher or crossword buff, there are a few types of standard grids of 15×15 to choose from. But these are not really required for school teaching. Any, including irregular or asymmetrical puzzles can be used. It all depends on the teacher's discretion. The grids most frequently used for children's crosswords are 10×10 or 11×11 as below.



10x10 REGULAR

10x10 IRREGULAR

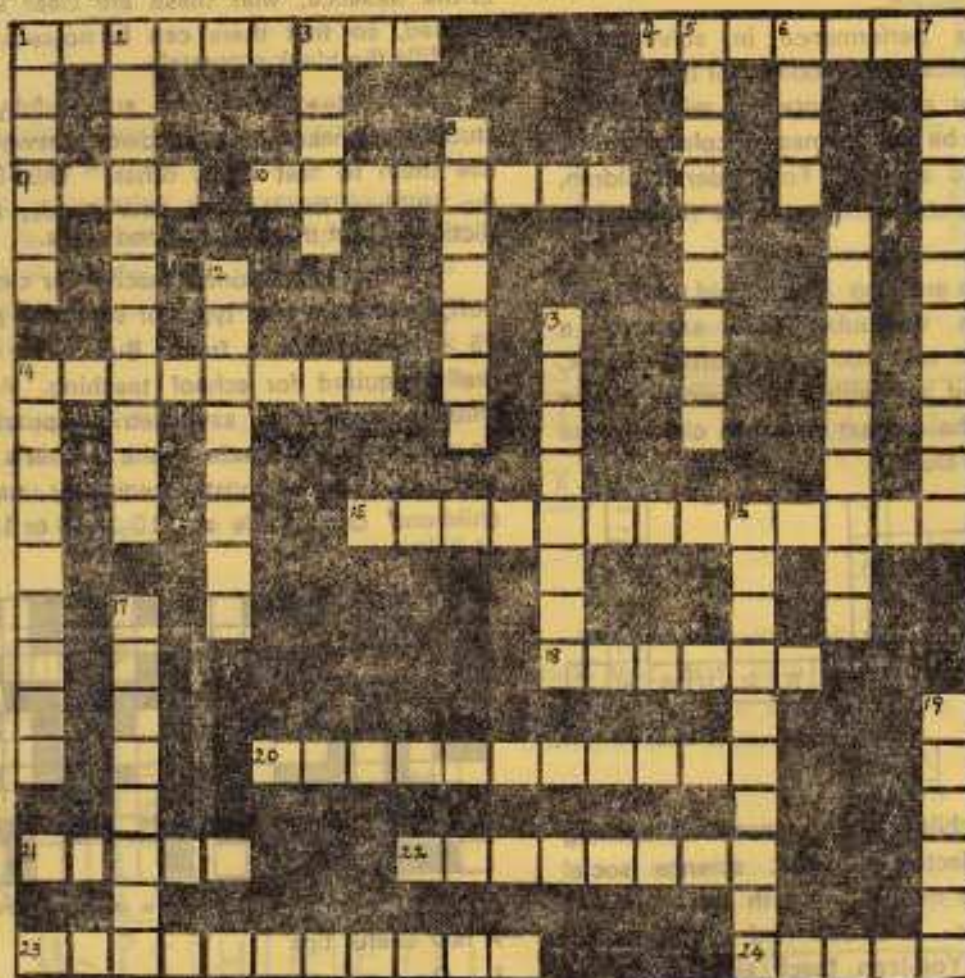
A few useful tips

- i. Once you have made up a crossword and found it successful in your class, file one copy for future re-use. In this way you can build up a valuable question bank.
- ii. If your school has cyclostyling facilities, you can get a number of blank grids of suitable size duplicated, store these away and use for planning your next crossword.

With a little ingenuity, a teacher can use crosswords very successfully to teach, reinforce and test. For the child, there is a valuable sense of achievement that comes from seeing one word leading to more and more correct answers. It is like being a student and an examiner at the same time. Can a student wish for more?

A TEACHERS' CROSSWORD PUZZLE

How up-to-date are you on the technical vocabulary of an educator? To follow Ms. Gadekar's article, here is a crossword just for you. Answers on page 16.



CLUES

Across

1. A teacher.
4. The teams
9. A remark with motivates every student.
10. In reply to a question.
14. Banned from of punishment.
15. Verbal and non-verbal interaction.
18. Abilities.
20. The result of misbehaviour.
21. Question.
22. Find out its worth.
23. Learning related to body-mind coordination.
24. They provide feedback on the effectiveness of your work.

Down

1. Name of well-known psychologist who studied stages of development of child.
2. If the students cannot do it with their own hands, the science teacher must
3. They develop the body.
5. Your goal.
6. As necessary as work.
7. Year-end bogey.
8. Idea.
11. Infants' learning.
12. The 'Q' of IQ.
13. Evokes a response.
14. Learning related to knowledge.
16. A student passing through a difficult period of physical and emotional adjustment.
17. Teaching technique.
19. Found in report cards.

An Alternative to Classroom Management in Rural Schools

A Background of Schools in Rural Areas

For a long time, children of all classes in primary schools located in rural areas have sat in rows, most often in a single room. Normally the oldest children, those in class V, sit in the front row, closest to the teacher. Farthest away from the teacher, in the rear of the room, sit the youngest children of class I.

The teacher, perhaps, sits on a chair which has only three legs and is supported by stones. Often he is in his own world. The blackboard is always full of letters—in Telugu and English—and numbers. Rarely can we find signs of a new lesson on it. However, the date changes at the top corner daily. The dull and dirty walls may have a few old charts hung on them. No fresh decoration can be found in the classroom, let alone any teaching aids—except for the long cane that lies on the table. The children usually play dot or line games in their notebooks; or make paper aeroplanes, ships and balls. Alternatively they chat, indulge in petty quarrels eat groundnuts or sunflower seeds. All these are common features of the rural Rayalseema region.

The teacher writes a few letters of Telugu on the slates of the Class I children and they are asked to spend the whole day overwriting them. Even if the teacher is inclined to teach, it is difficult for him to teach all the classes at a time. Even in those primary schools where two teachers are available, the same person may be required to teach up to three classes in one room. Therefore, the teacher usually teaches one class after another. He will call the children of class III to sit in front of him and teach them a lesson. The students of class IV will follow... and then those of class V. When the first batch of children return to their rows, most often they are asked to read the lessons, memorise questions and answers or copy-write.

Work finished, they spend their time pretending to read or write. In reality they are bored and and distracted; they disturb the teacher and seek excuses to go outside.

The Problems In This System

There are several. Single teachers find it difficult to cope with three to five classes, especially when the teacher-student ratio is generally more than one to fifty. One teacher is required to teach all subjects for all the classes and must cover the prescribed syllabus in all of them. The absence of any interesting extracurricular activities or exposure to thought-provoking education and the irregular attendance of the children add to the problems. In this article I would like to share some of our experiences on classroom management at the schools run by the Rural Development Trust.

Experiment I: After careful observation, a standard-wise grouping system of the children was introduced. Its main objective was to raise the children's ability to read and write. The children were divided into three groups, after administering suitable tests. This was helpful, as even some of the children in classes III, IV and V could not read and write fluently. Those who could not read and write or were slow learners formed a *Beginners' Group*. Teachers were asked to pay more attention to this group to bring them up to the age to class level. Students who were excellent in reading and writing and other activities, intelligent and quick formed an *Above Average Group*. The *Average Group* consisted of the others, who could by then read and write. In each group there were children from classes I to V. Seated in a circle, they helped each other and learnt more quickly. Even the youngest ones in the above average group learnt more, orally, merely by sitting with the older children. The

beginners' group quickly learnt reading and writing through different language games, exercises and teaching aids.

What We Learnt

After a year's trial with this system, we ascertained that

- i. Older children (class V) who sat with the younger ones (Class I) in the beginners' group were at first hesitant to mingle freely with the five-year olds.
- ii. In order to be promoted to class VI, the children of class V must finish their syllabus on time and take the class VI entrance examinations. Similarly promotions to class VII must follow and thereafter these students face a Government examination conducted by the District Education Board. For them, it was too late to start learning to read and write. It will be essential for us to concentrate on this group and improve their learning skills.
- iii. Given the pressure of examinations and the difficult textbooks for each class, it was a

problem to follow a suitable common syllabus to improve reading and writing,

- iv. Most teachers could not understand the objectives of this system.

Under this system, lessons of differing levels in the same subject have to be correlated. This requires much creativity and effort on the part of the teachers. They have to prepare their lessons according to the children's standards. They have to provide a variety of language and numeracy exercises, games and activities, particularly with the beginners' group. Teachers have to work at this task, if they wish to see good results as the fruit of their labour. When the children achieve something worthwhile, concrete improvement in their reading and writing skills, their attendance also improves. This in turn should help to reduce the drop-out rate.

To be continued—

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GOOD TIME KEEPING FOR A TEACHER

Have you ever sat down to plan your TIME for all these things ?

- * Time for Teaching
- * Time for Practice
- * Time for Revision
- * Time for Evaluation
- * Time for Innovation
- * Time for Reflection
- * Time for Preparation
- * Time for Comparing Notes
- * Time for Making Aids
- * Time for Pupils
- * Time for Excursions
- * Time for Enjoyment
- * Time for Refresher Courses
- * Time for Consultation
- * Time for all the other things in your life, besides teaching
- * Time for rest and recuperation

Successful organisation means good time keeping.

[Adapted from TEACHERTALK, Nov. '90 issue]

Trends in Social Studies Teaching

The subject of social studies is social and studies in every sense of the term. Its focus is on a study of man in society. Man and society are mutually interactive. If man created society, it is equally true to say that society has moulded man into a refined being.

In social studies therefore we study man as the creature of the environment as well as a creator of the environment.

History according to a famous historian, Arnold Toynbee, is a record of a series of challenges and responses. If history is a record of man's responses to challenges in the time dimension, geography is his collective response in the space dimension.

Economics is his effort at resource management and politics reflects his attempts at organising power. If man's mastery of science, physical and natural, led to great leaps in civilization, this is also a subject matter of social studies.

On the negative side man's efforts at decivilising the earth by pollution and destruction of ecology are also regrettably, but equally a subject of study in the social studies programme.

Recently, new emphases have emerged in the teaching and learning of social studies.

The age-old method of doling out information and marshalling of facts is today discredited. The teaching learning techniques in social studies have kept pace with the advancement of the teaching learning techniques in science, mathematics and other subjects.

The emphasis today is on learning the concepts and acquiring skills. This is done through the enquiry and self-discovery method.

There are three categories of objectives.

The conceptual objectives include knowledge and understanding of people, how they relate to one another and to their environment.

The emphasis is not on facts, but on the development of concepts, ideas, generalisations. The pupils, depending upon their experience and maturity should be introduced to concepts from all the social sciences - Anthropology, Ecology, Economics, Geography, History, Sociology and Psychology.

Enquiry objectives include using the various processes of enquiry such as observing, defining, classifying, interpreting, analysing, hypothesising, synthesising, evaluating. Intelligent enquiry into the data of social studies instruction, will lead, it is hoped, to further intelligent enquiry into the data and problems of social life, today's and tomorrow's.

Skill objectives include language abilities, and study abilities. Among them are such general skills as reading with understanding and specific skills like interpreting, chronologies, graphs, maps and illustrations.

Affective objectives include the various attitudes, interests and appreciation. Today, the greatest emphasis is on the democratic values of liberty, freedom of expression, the right to differ, respect and concern for preserving the rich environment and heritage. A positive concern for human life and an aversion for everything that goes against the dignity and liberty of the human being.

These four objectives should be kept in mind as attention is given to specific objectives in each unit of study and as instruction is moulded to meet local needs and conditions.

The Procedure : Ideally each unit of classroom instruction has a motivational introduction to arouse the pupils' curiosity and to give a focus for enquiry and learning.

The developmental activities, range from direct instruction and descriptive narration to problem analysis and discovery.

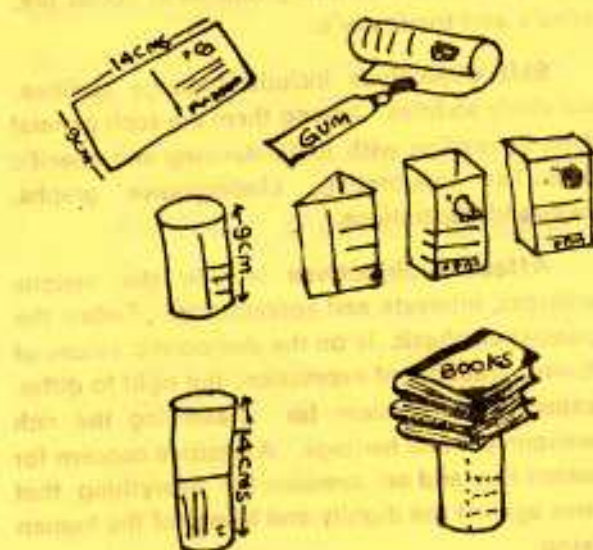
Whatever the mode the emphasis should be on pupil involvement and inductive learning. Pupils should be encouraged to raise their own questions and seek answers for them using their textbooks among other things as resources.

The unit typically ends with - synthesising activities, extension and application, suggestions for further individual and group enquiry.

In all these activities, the teacher serves as a catalyst to guide learning and also as a co-enquirer with the pupils in drawing upon various sources of data, issues and problems. With teacher's guidance, the pupils themselves observe, interpret, generalise and evaluate.

N. R. K. Moorthy
Hyderabad

POST CARD STRUCTURES



Everything has a structure. The human body, buildings, bridges, animals all—have a skeletal frame which bears the load. Using old postcards we'll explore a few structures.

All postcards measure 14×9 cm. Fold and glue a postcard into a 9cm tall cylinder. It doesn't look very strong. How much load can it support? Make a guess. Now slowly pile books on this column until it collapses. Place the books in the centre so that they don't tip off. The 9cm tall postcard cylinder is able to support nearly 4 kg of load. Try folding 9cm tall columns of different cross sections—triangular, rectangular, square, oval. Which cross section can sustain the most load? Why?

Fold postcards in various cross sections to make 14 cm high columns. Which cross-

section is the most efficient? Make two columns of the same cross sectional area, but one tall and the other short. Which supports more load? For the same cross-section of column, how does load bearing depend upon height?

Arvind Gupta

(Reprinted from Education : A Bulletin for Parents and Teachers on Alternative Education.)

WOULD YOU LIKE TO BE A MILLIONAIRE ?

What is a million ?

"A million is a lot of money. I wish I had a million to spend", said a student of class XI.

"A million what", queried a classmate.

"So ooo much and much more perhaps even more", felt a child of class VII, standing with arms spread out.

"Plenty ! Plenty of things", from a student of class VI.

"A very big number, maybe bigger than the biggest. Or no, I do not know" and "It's a very big number. I cannot think how big it is", came from class V.

"Let me think of a thousand things, say pencils I can think of five pencils, ten pencils, fifty, a hundred, two hundred may be a thousand. Yes, now a thousand times thousand God ! It is too much !", came from another student of class VI.

Class VIII put it simply as "a thousand thousand" and class X merely said "10".

These are some responses from students when we recently asked them the question : What is a million ?

One of the dictionary meanings of a million is "an indefinite but very large number".

Two years ago, something, somewhere had inspired the students and teachers of Sardar Patel Vidyalaya to collect a million objects. The aim - to be able to see a million. The objects selected for this honour were the bottle caps of various aerated drinks. The bottle cap fever struck everyone and the tinkle of metal bottle caps could be heard all over the school. A million however is after all a million (inflation notwithstanding), and despite fervent efforts the goal of making a million eluded us.

Well, a million is not something one can overlook for long. As the new session began, the fervour to make a million took hold again. We were now thinking of a million matchsticks. The planning began.

We needed 1000,000 matchsticks. That equalled a collection of 20 000 matchboxes, each containing 50 sticks. This meant 2000 packets of 10 matchboxes each.

As we had nearly a thousand students from class IV to XII, it was decided that each student would contribute 2 packets of 10 matchboxes each. The matchboxes were to be returned to the donors after our "million" had been put on display. Circulars were sent out requesting parents to help us realise our goal of collecting a million. Parental reaction ranged from indifference and cynicism to apprehension and to positive enthusiasm. Luckily it was the last group that formed over 80% and this helped us enormously. Quite confident that our efforts were going to be successful, our planning entered the second phase. We had to think about :

- * the mode of collection
- * provision of adequate storage space
- * a suitable site for the display, and
- * how to display our collection.

Decisions regarding the first two points were reached quickly. We looked for a place which could be easily guarded, which was safe and where the collection could not accidentally catch fire.

In selecting a site for the display, we wanted to ensure that it would catch the attention of the maximum number of students and could be seen by any interested parents. The best spot turned out to be the large verandah outside the school auditorium, facing the main gate of the school. There the collection attracted the eye of every

person entering the school. The guard at the gate also kept an eye on the display.

The design of the display had to convey the largeness of "a million—"but how? That was million-dollar question. We had decided not to open the packets, as this would have created problems at the time of returning them to the children. Considering various possibilities was a lot of fun. We thought of arranging the packets in *rangoli* designs, as a wall, as a pyramid and so on. The pyramid appeared to be more suitable than any other shape. It seemed during the discussion that we were trying to convey an idea of the size (volume) of a million and the pyramid, though compacts gave a good concept of the bulk. Many of the alternatives considered were either unstable or beyond manageable limits of available floor space.

Next the size of the pyramid had to be worked out. 2000 packets had to be placed in the required shape. The first possibility was a pyramid with a square base of 17×17 packets, or 18×18 packets. We would then reduce one packet on each side in successive layers. But,

$$1^2 + 2^2 + 3^2 + \dots + 17^2 = 1785.$$

The total was short of the required 2000.

$$1^2 + 2^2 + 3^2 + \dots + 17^2 + 18^2 = 2109$$

This was 109 packets in excess.

Next we worked out

$$(18 \times 17) + (17 \times 16) + (16 \times 15) + \dots + (2 \times 1) = 1938,$$

a number just 62 short of 2000.

If the arrangement of our display was to be guided by this series, we had to adjust the 62 packets somewhere. We decided that this could be done by putting in identical double layers at two stages. The first would be at the 7×6 stage (42 extra packets) and the other at the 5×4 stage (20 extra packets).

The actual size of the pyramid worked out to a base of $126 \text{ cm} \times 119 \text{ cm}$ and its height was 95 cm. Readers might be interested to note

the dimensions of a standard sized match box: length 4.9 cm, breadth 3.5 cm and height 1.4 cm. A packet of ten matchboxes was found to be $7 \text{ cm} \times 7 \text{ cm} \times 4.9 \text{ cm}$.

In order to show the million *matchsticks*, we felt that the packets forming the faces of the pyramid could be slit open to reveal the trays containing matchsticks.

"That isn't big enough", felt some friends.

"Well, that is a million and why should we make it look more that what it is", retorted some others.

The students of Classes X and VIII helped in the putting up of the display. In a little over two hours, our matchbox monument stood majestically in the front verandah. To ensure that children realized the enormity of the number, a chart was put up nearby. On it were displayed plastic packets containing 10, 100 and a 1000 matchsticks.

Next morning the children of class IV came formally to visit the pyramid.

"So very big", remarked one. "It's a million!"

Suddenly someone asked, "Are my boxes in there?"

"Yes, of course! Or else how will it make a million?"

"But is it really a million?" asked another child.

I put two packets (twenty boxes) in the hands of a child and asked the class how many matchsticks he was holding. Some further questions and clarifications a quick calculation and the answer was there 1000 sticks. Everyone wanted to hold 1000 sticks in his/her tiny hands.

"This is a thousand and oh! look at a million!"

Suddenly our monument of a million matchsticks had become so meaningful.

How big must our hands grow to hold a million? How big must we grow to have such big hands? Can anyone in the school hold a million in his/her hands? Such discussion arose spontaneously amongst the children.

Another remark : The collection must have weight. How much do you suppose a million matchsticks weigh?

If we had collected a million pencils instead of matchsticks, how big would our collection have been?

We could have collected a million tetrapacks.

Class X students, who had been sitting there listening, took over as guides for the exhibit. It turned out to be a wonderful experience for all of us.

We haven't yet given up on a million. As part of a mathematics activity, I want my students of class VI to watch a collection grow slowly into a million. I intend starting with 500 toothpicks and work out a schedule so that by the end of the year we can set up a display of 1, 10, 10^2 , 10^3 , 10^6 toothpicks.

A suggestion to readers : Do try to make a million in your school. It is an experience well worth the effort. Not only does it help in better understanding of the decimal system of numeration, valuable learning takes place on several other fronts as well. I would be delighted to exchange views and suggestions with any interested teachers.

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WORK THESE OUT

1. A fullstop is about 1 mm across. If 1 million such fullstops are placed next to each other in a line, how long will the line be?
2. A sheet of paper is about 0.1 mm thick. In a packet there are 500 sheets. How many packets would make up a million sheets? What would be the thickness of a million sheets?
3. A large postage stamp might have a mass of about 50 milligrams. Compare the mass of a million such stamps with your own mass.
4. If you were to start counting the tiny squares (1 sq mm each) on a sheet of graph paper at the rate of one square per second and did n't stop to eat or sleep, how long would it take you?
5. If you feel a million is too small a number, find out what a billion, a trillion and a googol are.

[Answers on Page 16]

Solving Maths Word Problems

To many young children maths problems represent a nameless, but very real, bogey an unknown, horrible thing..... something they are frightened of. Help them overcome this fear by teaching specific *problem-solving strategies*.

Strategy 1: Decode the problem using a code word—**RILL**. Each letter tells you the steps to follow when you meet a maths problem.

R Read the the problem carefully.

I Imagine a picture of the problem. Draw it, if that helps.

L Look for the unknown in the problem.

L Look for useful data (information) in the problem.

Example : Sunder wants to estimate the number of feathers on his 6 birds. He guesses that there are about 10 feathers on each square centimetre of a bird. He figures that each bird is covered by about 50 square centimetres of feathers. How many feathers will all his birds have ?

Read the problem : There are birds—how many ? ————— feathers per square centimetre ? ————— square centimetres per bird ?

Imagine a picture : Sunder counting feathers on one bird five others nearby.

Look for the unknown : You are looking for the total number of feathers.

Look for useful data : How many birds ? How many feathers per sq cm ? How many sq cm per bird ?

Now use the same sequence to systematically solve these problems :

1. Rita loves eating plums. One day she ate 2 for breakfast, 4 for lunch and 6 after dinner. How many did she eat in all ?
2. Mohan's mother bought 2 dozen eggs. The family used up 8 of them. How many are left ?
3. Sunder made 2 sandwiches for himself and for each of his friends to eat at the class picnic. 20 boys went on the picnic. How many sandwiches did Sunder make ?

More in the next issue of *PATHWAYS*

WORK THESE OUT

- | | | |
|--------------|------------------------------------|-----------------------------|
| 1. 1 km | 2. 2000 packets, 400 m | 3. 1 million Stamps — 50 kg |
| 4. 11.5 days | 5. 10^5 , 10^{12} , 10^{100} | |

A TEACHERS' CROSSWORD PUZZLE

ANSWERS

Across : 1. Pedagogue 4. Compete 9. Good 10. Response 14. Corporal
15. Communication 18. Skills 20. Punishments 21. Query 22. Evaluate
23. Psychomotor 24. Tests

Down : 1. Piaget 2. Demonstrate 3. Games 5. Objective 6. Play 7. Examination
8. Concept 11. Intuitive 12. Quotient 13. Stimulus 14. Cognitive
16. Adolescent 17. Strategy 19. Grades